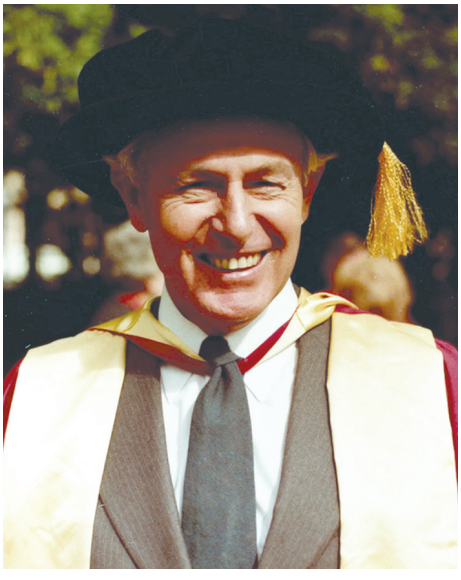
Obituary
Raymond Louis Specht, 1924–2021



Raymond Louis Specht, PhD (Adel), DSc (Adel), AO, Professor Emeritus at The University of Queensland, died on 13 February 2021, after a long life of 96½ years. He had a very rich life of enormous productivity in his chosen fields (Australian flora, the study of ecosystem processes, and the conservation of Australia's biota) and was a tireless promoter of the better education of young Australians in the sciences.

General Introduction

Ray was born into a close-knit family in Adelaide and quickly showed his scholastic aptitude and curiosity to learn. He was dux of his primary school in Richmond and was part of a band of bright young men at Adelaide Boys High, including Glenorchy McBride (who became Professor of Psychology at The University of Queensland). These boys kept in contact for the rest of their lives. The Second World War was in full flight when he graduated from high school and, teachers being in short supply and family funds limited, he attended Adelaide Teachers College and very soon after was sent to a small school at Riverton to teach students not much younger than himself. Luckily, he had the slightly longer experience of another Adelaide High School graduate, John Womersley, to draw upon, and the mentoring eye of their extraordinary teacher, Stan Edmonds, later of the University of Adelaide and the South Australian Museum. Ray transitioned to university (the two institutions were quite intertwined), studying biology and ecology, despite having previously excelled at the hard sciences. He was inspired by the teaching of J. G. Wood, writing as an honours student in 1946: "… ecology is really a pure science aiming at the study of communities for the sake of knowledge. Who knows what may evolve from it? Did Thomson, Rutherford, Bohr, or any other early atomic physicist realize whither they were going when they delved into the secrets of the atom?" (Specht, 1946).

Profs J. G. Wood, C. T. Madigan and Sir Douglas Mawson, world-renowned authorities in their fields, were teaching at the University of Adelaide at this time, and they impressed the young Ray. In addition, he was exposed as a student to the Koonamore Vegetation Reserve, which was established in 1925 by J. B. Cleland and T. G. B. Osborne. This reserve (later known as the T.G.B. Osborne Vegetation Reserve) was globally unique at the time and impressed on Ray the value of long-term observations (Hall et al., 1964) and integrating teaching with field work. Shortly after gaining his honours degree, for an ecological survey of the Adelaide Hills (Specht, 1951), he had the first of his formative scientific experiences, as a grassland ecologist on a survey of the south-east of South Australia. Bob Crocker, a soil scientist, also had a great influence on the development of Ray's understanding of the whole-of-ecosystem approach which came to the fore in his selection of his doctoral sites some years later.

Ray's second formative experience was as the botanist on the National Geographic, Smithsonian Institution and Australian Department of the Interior (via the enthusiastic support of Arthur Calwell) Expedition to Arnhem Land in 1948 led by C. P. Mountford. It was a position to which Prof. Wood 'co-opted' him, as Ray liked to say. It was a mammoth task as the youngest member of the team, but he acquitted himself with great credit, collecting 13,500 specimens in total, replicated to send to ten herbaria including Kew, the Smithsonian, and the Rijksmuseum in the Netherlands. Ray's participation was clearly a seminal part of his career. Apart from an immense practical learning experience, he was instrumental in ensuring that the work of the Expedition was published (see Specht, 1958a–e, 1964; Specht & Bateman, 1958; Specht & Mountford, 1958). Through this expedition he made lifelong friendships with fellow expeditioners and associates in the USA and Australia. Both before and after the Expedition, he visited the Herbarium in Brisbane to consult with the crucially important reference collections of tropical species and avail himself of the expertise of staff of the calibre of C. T. White, Stan (S. T.) Blake and Selwyn Everist, among others. It was in Brisbane that he met his future wife, Marion Gillies, a zoology student at The University of Queensland.

His connection with Arnhem Land was revitalised some years into his retirement. In 1998, he (with the author's help) ran a reunion of the Arnhem Land expeditioners in Sydney, which proved to be the last time they all got together (except for one member who had died much earlier) (Specht & Specht, 1998). When 'outsiders' started to realise the unique nature of the Expedition, and people started studying it, Ray took this very seriously and organised and donated documents and artifacts, submitted willingly to interviews, and generally took on the role of spokesperson for the expeditioners. In 2009 the National Museum ran a Symposium 'Barks, Birds and Billabongs', by which time Ray was one of only two expeditioners left alive, shortly after to be the only one. His memories were captured in two chapters of the publication resulting from the Symposium (Thomas & Neale, 2011).

After the Arnhem Land adventure he returned to Adelaide University, completing his PhD in 1953 under the supervision of J. G. Wood, with a comprehensive study of the heath of the Ninety Mile Desert (a system of ancient sand dunes, described by Crocker) in eastern South Australia. It was this study and the several publications that emerged that launched the next phase of his career, the nutritional aspects of heathland vegetation. He obtained Fulbright, Smith-Mundt and Carnegie Fellowships to study in the USA and France in 1956. His scientific standing and international connections were further expanded. In 1961, he was awarded the Verco Medal of the Royal Society of South Australia for distinguished scientific work, the highest honour that the Society can bestow.

After Joe Wood's untimely death in 1959, Ray took up a position at the University of Melbourne as Senior Lecturer and then Reader (the equivalent of Associate Professor) in Botany. It was arguably the happiest phase of his career, with few administrative responsibilities, a great team of fellow staff and students, and under the inspired leadership of John Stewart Turner (FAAS) with whom Ray formed a great friendship as well as intellectual companionship. This time took him to Oxford University on a Royal Society–Nuffield Foundation Commonwealth Bursary to work at the Department of Agriculture under the sponsorship

of Prof. Geoffrey Blackman. Through this, and the mentorship of Prof. Turner, he was given responsibility for three programs in Australia (and one internationally) in the newly established International Biological Program (IBP) which is further described later.

In 1966, Ray moved to The University of Queensland as Professor and Head of Department, after the retirement of Prof. Herbert, the noted biogeographer whom he had met and greatly respected. Ray often enjoyed telling the story that when he arrived, the head of the technical staff of the Botany Department, Albert Steginga, informed him that as a baby he had been "dandled on the knee" of Ray's great-grandfather. That was Wilhelm, the first of the Spechts to settle in Australia, who had moved from Adelaide to Rockhampton where for a time he was employed at the railway workshops. Ray liked to think that a piece of rolling stock had his name stamped into it.

Ray brought the IBP with him to Queensland. This was a key motivator for his engagement with the Queensland scientific and practitioner community. This community included the strong research and modelling teams of the Queensland Department of Primary Industries, which were greatly influenced by the innovative management style of the research directors and the intellectual leadership of Dr Joe Ebersohn. It was an exciting time to be in Queensland. He took pleasure in integrating the research of the botany staff with the teaching program, with a notable focus on North Stradbroke Island, a place which complemented his PhD work on the dynamics of the vegetation on the ancient dunes in South Australia.

Throughout his life, Ray maintained active collaborations with scientists around the world. When he retired in 1989, he was appointed Professor Emeritus of The University of Queensland. He was thrilled to receive life membership of The Royal Society of Queensland in 2015, and an AO in 2020. He greatly enjoyed being a member of the advisory committee for Queensland's Statewide Landcover and Trees Study (SLATS) long into his retirement, and continued publishing many articles and books, only slowing down with the ill-health of his wife and later of himself.

The following sections cover some of his contributions in more detail.

Contribution to Education

Ray applied his expertise as a trained high school teacher in several ways, in particular through his use of field work in his undergraduate classes. He was an early promotor of self-reflection on teaching methods long before this became routine in Australian universities. He advocated North Stradbroke Island as a great opportunity for field studies to enhance learning outcomes (e.g. Specht, 1975), and he and his good friend Professor Emeritus H. T. Clifford, AM, wrote *The Vegetation of North Stradbroke Island, Queensland*, which was used by generations of students and visitors to the island (Clifford & Specht, 1979).

Particularly notable was his promotion of new advances in high school teaching being made in the United States of America in the 1960s and '70s. He was a contributor to and champion of the 'Web of Life' program for Australian high schools, which was developed under the auspices of the Australian Academy of Science in the late 1960s. This was inspired by the innovative Biological Sciences Curriculum Studies program in the United States of America, and Ray visited their headquarters in Boulder, Colorado in 1970. It emphasised the 'inquiry method'[a] of teaching and was demonstrably better for student understanding and retention, but often a challenge for educators! Together with his wife, he steered the adoption of the method in Queensland (Specht & Specht, 1995).

In his university teaching he established a new third- and fourth-year subject, 'Community Physiology', in which his students used a computer model created by him (initially in Fortran) to predict the effects of different environmental scenarios

[a] Scientific inquiry involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in the light of experimental evidence; using tools to gather, analyse and interpret data; proposing answers, explanations and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations (National Research Council, 1996, p. 23).

on Australian ecosystems. This model, COMSIM, used the index-based approach published in his article in *Oecologia* (Specht, 1981a) and his book chapter in the *Ecological Biogeography of Australia* (Specht, 1981b). This semester-long exercise provided great learning opportunities as well as amusement, as students assessed different scenarios, such as the creation of a rainforest in Canberra or central Australia, and predicted how much irrigation and protection from evaporative loss would be required to do so.

Ray did not have a vast number of doctoral students and postdoctoral researchers, but those he did have were greatly treasured and made significant contributions in their turn, for example Richard Groves, Richard Jones, David Jeffrey, Bob Parsons, Matt Bolton, Jim Davie, Elwyn Hegarty and Rhonda Melzer. He was noted for his constructive feedback at every seminar and contributed actively to all the postgraduates who came into his orbit.

After his retirement at the age of 65, he embarked on the production of a major textbook entitled *Australian Plant Communities: Dynamics of Structure, Growth and Biodiversity.* This was published by Oxford University Press and sold so well as to merit a second edition and a subsequent reprint (Specht & Specht, 1999, 2002). This text, shortlisted as *The Australian* newspaper's Tertiary Scholarly Reference of the Year in 2000, encapsulated the extensive scientific experience accumulated through his long career, making it a seminal text for Australian university courses in ecology, eco-physiology and geography, among others, as well as a great boon for environmental practitioners.

Research Leadership and Contribution to Conservation

Ray attained global pre-eminence due to his knowledge of the nature and dynamics of sclerophyll vegetation, established through his PhD work on Dark Island Heath, South Australia. This was evidenced by his editorship of the 'Heathlands and Related Shrublands' volumes in the *Ecosystems of the World* series (Specht, 1979, 1981c) published by Elsevier (series edited by David Goodall AO), and other books by international publishers (e.g. de Castri et al., 1981; Keast & Specht, 1981).

The International Biological Program (IBP) (Specht & Specht, 2020) was an innovative global initiative to examine the biological basis of productivity and human welfare, recognising that traditional methods of biological research were insufficient to tackle complex environmental problems. Ray was assigned an amalgamated suite of responsibilities: productivity, production processes, and the conservation of terrestrial communities (Section PCT). He was convinced of the potential of the integrated nature of the work proposed, both in the range of ecosystem components being simultaneously studied and the interdisciplinary nature of the teams required to do the work. He gathered a diverse team of experts at The University of Queensland to establish an integrated laboratory and field installation (in Brisbane at the Archerfield Aerodrome), the envy of most facilities in Australia at the time. For the conservation stream, with a team of collaborators at The University of Queensland and across the nation, he conducted an Australia-wide assessment of the conservation status of Australian plant communities, which became known as the 'Specht Report' (Specht et al., 1974). At the regional scale he applied a methodology established through the IBP for the determination of conservation areas (Bolton & Specht, 1983), later adapted by Purdie (1990) for the systematic selection of conservation reserves. Ray's last publication was a reflection on the IBP and its place in Australian engagement internationally (Specht & Specht, 2020).

One of his most influential contributions set the standard for the description of the structure of vegetation, until then a very contentious matter. Ray proposed a simple vertical and horizontal classification of vegetation by which plant communities could be categorised structurally (Specht, 1970; Specht, 1981d; Specht & Morgan, 1981). Without such consensus, conservation efforts fell to nought as ecosystems could not be consistently described and their descriptions shared adequately to establish their conservation status. This was further refined in Specht & Specht (1999, 2002). The 'Specht structural classification' is the foundation of the measurement protocols established by many organisations. Foliage Projective Cover (FPC), the horizontal component of this classification, is reliably determined remotely allowing vegetation cover and cover type to be monitored

(Armston, 2009; Johansen et al., 2015; Fisher et al., 2018). FPC continues to be used effectively in assessments of biomass, Net Primary Production (NPP), nutrient dynamics, and carbon sequestration at various scales through input to models like Aussie GRASS (Carter et al., 2000) and Century (Parton, 1996).

Ray was committed to optimal conservation of biodiversity and ecosystems, especially Australian ecosystems. He was President of the Victorian National Parks Association in the 1960s, on the founding committee of the Australian Conservation Foundation, and a founding member of the Ecological Society of Australia. He was not an activist, but worked to provide the basis for sound assessments, relying on the data and work he produced to speak for him. He supported the publication of Australian-focused scientific journals, only newly emerging in the 1950s and 1960s, especially through his many publications in the *Australian Journal of Botany*.

Ray was a pioneer in the application of digital technologies in science, particularly in the determination and assessment of our native biota. He was ahead of his time as a 'Big Data' innovator, inspired by his experiences with the IBP, various scientific committees and projects. Recognising the limitations of expert opinion in determination of the occurrence of plant communities used for the Specht Report, and inspired by the new computing capacity and work using non-parametric analyses to define 'clusters' in otherwise impenetrable datasets (e.g. the techniques developed by Bill (W. T.) Williams, FAAS), Ray embarked on a project to find and digitise all the vegetation surveys published in Australia, with a vision of objectively defining them. In this he was amply assisted by the data science team at CSIRO in Brisbane, which included Bill, but also the talented Mike Dale. This project was larger than initially anticipated and took him well past retirement age. Finally, with the help of co-authors and despite opposition from various quarters, in 1995 the *Conservation Atlas of Australian Plant Communities* (Specht et al., 1995) was published, and launched by the head of the Australian Conservation Foundation.

Much of the raw data assembled and collected for the definition of Australian Plant Communities has recently been recovered (Specht et al., 2018a) and deposited in open-access repositories, including the *Atlas of Living Australia* (https://collections.ala.org.au/public/show/dr8212) and the USA-based Knowledge Network for Biocomplexity (Specht et al., 2018b). This is a testament to the enormous amount of work accomplished by Ray and collaborators.

Closing Remarks

Over the course of his life Ray published 106 scientific articles (48 as sole author), 77 book chapters (15 as sole author), was the author or editor of 16 books (4 as sole author), and spoke at countless conferences and symposia. It should be remembered that:

(a) until the 21st century, publications were all in print, and correspondence was by post;
(b) books with voluminous appendices were the norm (there were no online data repositories); and
(c) publications in ecology normally were (and still are) fewer in number than those in the laboratory or molecular sciences.

Given these limitations, he may be seen to have been very productive. He fervently hoped that his work enhanced understanding of our biota, influenced the way it is managed, informed the way we educate the next generations, and encouraged original, critical thinking.

Ray's work was his life, and his students and colleagues became friends for life. He had a passion for acquiring and sharing knowledge. His networks were wide but also deep, and in many cases extended across generations.

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